

**REMARKS**

Claims 1-5 and 8-17 are pending in this application. By this Amendment, claims 1-5, 9, 14 and 17 are amended to provide antecedent basis and for clarity. Support for amended claims 3-5 can be found, for example, at page 19, lines 10-35, page 25, lines 17-26, page 26, lines 1-26 and pages 29-30. No new matter is added.

Entry of the amendments is proper under 37 CFR §1.116 because the amendments: (a) place the application in condition for allowance (for the reasons discussed herein); (b) do not raise any new issue requiring further search and/or consideration (as the amendments amplify issues previously discussed throughout prosecution); (c) do not present any additional claims without canceling a corresponding number of finally rejected claims; and (e) place the application in better form for appeal, should an appeal be necessary. The amendments are necessary and were not earlier presented because they are made in response to arguments raised in the final rejection. Entry of the amendments is thus respectfully requested.

**I. Claim Objections**

The Office Action objects to claims 1 and 3 because of minor informalities. By this Amendment, claim 1 is amended at line 5 to insert "metal material." Additionally, by this Amendment, claim 3 is amended to recite "maintains." Accordingly, reconsideration and withdrawal of the objections are respectfully requested.

**II. Claim Rejection Under 35 U.S.C. §112, First Paragraph**

The Office Action rejects claims 1-5 and 8-17 under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. Applicants respectfully traverse the rejection.

The Office Action rejects claim 1 because of the terms "substantially separated." By this Amendment, the term "substantially" is deleted. The Office Action acknowledges that there is written description support for "separating NO, NO<sub>2</sub> and/or N<sub>2</sub>O<sub>4</sub> gas formed in the

treatment bath" at page 9, lines 30 and 31 of the specification. See Office Action at page 5, line 8. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**III. Claim Rejections Under 35 U.S.C. §112, First Paragraph**

The Office Action rejects claims 1-5 and 8-17 under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Applicants respectfully traverse the rejection.

**A. Claim 1**

The Office Action asserts that claim 1 lacks antecedent basis because of "the amount of Fe ions." By this Amendment, claim 1 is amended to recite "an amount of Fe ions." Furthermore, the Office Action asks what is the relationship between the Fe ions and the metal ions that form a complex with the phosphate ions (from claim 1, line 8). The metal ions (such as Zn, Fe, and Mn) include Fe ions, which are derived from an Fe electrode or a metal material article to be treated of a steel material. The metal material article to be treated may be a material other than a steel material.

The Office Action also asks whether "a standard hydrogen electrode" in line 21 is the same as the hydrogen standard electrode recited in claim 1, line 12. By this Amendment, claim 1 is amended at line 12 to recite "a hydrogen standard electrode potential" and at line 24 to recite "the hydrogen standard electrode." Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**B. Claim 2**

The Office Action asks whether in claim 2, lines 2 and 3, "an electrode material that dissolves in the treatment bath" is the same as the "Fe electrode or a metal material article to be treated of a steel material" recited in claim 1, lines 17 and 18. The answer is yes.

According to the specification at page 19, lines 6-9, "Fe ions dissolve in the treatment bath when a steel material is used as the article to be treated and when an Fe electrode is used for the film-forming metal electrode in electrolytic chemical treatment." Thus, the electrode material that dissolves in the treatment bath is the same as the Fe electrode.

The Office Action also rejects "the metal ions that form a complex with the phosphoric acid" as lacking antecedent basis. By this Amendment, claim 2 is amended to recite "a phosphoric acid." Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**C. Claim 3**

The Office Action asks whether "dissolving an amount of Fe ions into the treatment bath" in claim 3, line 2 is the same as "the amount of Fe ions dissolved into the treatment bath.?" By this Amendment, claim 3 is amended to recite "wherein the amount of Fe ions dissolved into the phosphate chemical treatment bath." Thus, claim 3 properly depends from claim 1 because the amounts of the dissolved Fe ions is the same. Additionally, by this Amendment claim 3 is amended to recite "800 mV to 960 mV." Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**D. Claim 4**

The Office Action asks whether the amounts of Fe ions in line 3 of claim 3 is the same as the amount of Fe ions dissolved as recited in claim 1, lines 16-17. As with claim 3, the amount of Fe ions in the treatment bath of claim 4 is the same as claim 1. By this Amendment, claim 4 is amended to recite "the amount of Fe ions dissolved into the phosphate chemical treatment bath." Additionally, claim 4 is amended to recite "700 mV to 960 mV." Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**E. Claim 5**

The Office Action rejects "an electrode." By this Amendment, claim 5 is amended to recite "comprising a second electrode" because the electrode is not restricted to an Fe electrode. For example, an insoluble electrode can be used, such as a nickel electrode as used in the examples. See the specification at page 39, lines 7-13. Additionally, claim 5 is amended to recite "770 mV to 960 mV." Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**F. Claim 9**

The Office Action rejects claim 9 because "electrolytic treatment" is not preceded with the word "the." By this Amendment, claim 9 is amended to recite "the electrolytic treatment" in the third and fourth lines of the claim. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**G. Claim 13**

The Office Action compares "exposing the removed treatment liquid to the atmosphere" in claim 13 to "exposing the treatment liquid to the atmosphere" in claim 17 and asks whether there are two separate independent exposing steps being carried out in the method. Both claims recite the same step for separating N<sub>2</sub>O<sub>4</sub> and/or NO<sub>2</sub> gas. By this Amendment, claim 17 is amended to recite "NO<sub>2</sub> and/or N<sub>2</sub>O<sub>4</sub> gas is separated from the phosphate chemical treatment bath comprising." Thus, the rejection of claim 13 is now moot. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**H. Claim 14**

The Office Action rejects claim 14 as allegedly lacking antecedent basis. By this Amendment, claim 14 is amended to recite "800 mV to 960 mV." Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**I. Claim 17**

The Office Action rejects "separating NO<sub>2</sub> and/or N<sub>2</sub>O<sub>4</sub> gas." As discussed above, claim 17 is amended to recite "NO<sub>2</sub> and/or N<sub>2</sub>O<sub>4</sub> gas is separated from the phosphate chemical treatment bath comprising." Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**IV. Claim Rejection Under 35 U.S.C. §103**

The Office Action rejects claim 1-5 and 8-17 under 35 U.S.C. §103(a) as being unpatentable over EP 1,074,640 A1 ("EP'640") in combination with Matsuda (U.S. Patent No. 5,645,706). Applicants respectfully traverse the rejection.

By this Amendment, claim 1 recites at least the following features: "a pH of less than 2;" "Fe is present and an amount of Fe ions dissolved in the phosphate chemical treatment bath is controlled by changes in the amount of Fe ions dissolved into the phosphate chemical treatment bath from a Fe electrode or a metal material article to be treated of a steel material;" "NO<sub>2</sub> and/or N<sub>2</sub>O<sub>4</sub> gas is substantially separated from the treatment bath;" and "ORP is 770 mV to 960 mV."

As discussed in detail during Applicants' August 24 personal interview with Examiner Wong, these features, as combined, are critically important in substantially eliminating sludge formation, and are nowhere found, as combined, in '640. This combination of features also corresponds to the many examples involving a pH of less than 2 in the specification, as filed, and the conclusion that ORP should be raised and maintained at values higher than 770 mV. See specification, as filed, for example, at Table 9, page 35; Table 14 showing Example 4; page 19, line 1; page 41 and page 43, lines 2-3; and page 44, lines 15-20.

In particular, when ORP is over 770 mV, dissolution of Fe proceeds to Fe<sup>3+</sup>, whereas in the absence of such an ORP, Fe<sup>3+</sup> solidifies and sludge forms. See specification, page 19, lines 10-35. By controlling the amount of Fe-phosphate complex that is replenished, the

reaction from  $\text{Fe}^{2+}$  to  $\text{Fe}^{3+}$ , and its reverse reaction, are omitted. The resultant bath contains a stable  $\text{Fe}^{3+}$  complex. This replenishing of Fe-phosphate complex, in addition to pH, have a profound effect on ORP. See specification at page 25, lines 17-26; and page 26, lines 1-26. Additionally, the preferred ORP range is maintained by separating  $\text{NO}_x$  gases, i.e.  $\text{NO}_2$  and  $\text{N}_2\text{O}_4$ , from the treatment bath by, for example, circulating the bath in a manner so as to allow  $\text{NO}_2$  and into  $\text{N}_2\text{O}_4$ , to escape to the atmosphere. See pages 29 and 30. Each limitation of claim 1 thus plays an important role in prohibiting sludge formation.

In contrast, '640 discloses only a phosphate treatment method in which pH is broadly disclosed to be .5-5.0; and wherein ORP is broadly disclosed to be 200-1000 mV. In particular, '640 discusses the advantages of a wide pH range in order to accommodate a composition of the treatment bath. In fact, '640 specifically discloses a preference for pH higher than 4.0. See '640 at paragraph [0218]. Additionally, '640's overly broad disclosure of 200-1000 mV ORP fails to specify the criticality of an ORP of greater than 770 mV. Each of Examples 1-5 of Table 8 in '640 discloses an ORP of less than 400 mV. This makes sense because '640 discloses a method in which reactions for other than film formation occur in the bath. For example, Fe proceeds to  $\text{Fe}^{3+}$  which causes sludge. Nowhere does '640 disclose prohibiting the formation of excess  $\text{Fe}^{3+}$ , thereby prohibiting non-film forming reactions. Likewise, '640 nowhere discloses substantially separating  $\text{NO}_2$  and  $\text{N}_2\text{O}_4$  from the treatment bath.

Thus, '640 teaches directly away from the claimed pH and ORP, and nowhere discloses or suggests the claimed specific combination of pH and ORP values, in combination with 1) separating  $\text{NO}_2$  and  $\text{N}_2\text{O}_4$  from the treatment bath, and 2) replenishing the Fe ions. Hence, '640 clearly nowhere discloses, inherently or expressly, the combination of the features or advantages of instant claim 1.

Furthermore, '640 fails to teach controlling the amount of Fe ions dissolved in the treatment bath as required by claim 1. For example, the amount of Fe ions dissolved in the treatment bath may be controlled by decreasing an electric current, as demonstrated in Example 1 of the instant specification. Example 1 describes using 0.6A in "anodic electrolysis" and "cathodic electrolysis Fe," while Example 1 set forth in '640 uses 28A and 51A in "anodic electrolysis" and "cathodic electrolysis Fe."

Moreover, Matsuda fails to remedy the deficiencies of '640 with respect to at least claim 1. Firstly, Matsuda is an *electroless* system in which sludge is invariably precipitated due to the existence of reactants in solution phase. Matsuda is entirely different, as an *electroless* system, than the claimed *electrolytic* system.

As explained in detail by Mr. Matsuda himself during the August 24 personal interview, Matsuda's electroless system requires a promoter for the reaction; its ions exist in solution phase; the anode and cathode reactions occur on the same surface; and no NO<sub>2</sub> and/or N<sub>2</sub>O<sub>4</sub> gas is separated. Moreover, Matsuda attempts to create and maintain a condition in its chemical treatment bath that avoids sludge from forming by limiting phase transition only to the formation of the coating on the metal to be treated. See Matsuda, col. 7, lines 58-60. Matsuda concedes that it has not fully accomplished the removal of sludge insofar as it describes a second use for the filtering pump as "removal of the sludge which is produced in the treatment bath." See Matsuda, col. 8, lines 60-65.

In its failed attempt to adequately address the formation of sludge in the bath, Matsuda also describes a chemical bath having a pH of 2.0-4.0, preferably 2.5-4.0. See Matsuda, col. 8, lines 23-27 and col. 14, lines 27-28. Moreover, Matsuda requires a bath having an oxidation-reduction potential (ORP) of 460-860 mV. See Matsuda, col. 13, line 17. Accordingly, Matsuda's 13 examples are limited to a bath having a pH of more than 2.5 in combination with an ORP of less than 800 mV. See Matsuda's examples, col. 16-28. This

combination of high pH and low ORP, as well as being an electroless system, undoubtedly contributes to Matsuda's sludge problem because, for example, Fe does not fully remain in solution in a bath having an ORP of below 770 mV, which is one reason that Matsuda's method *requires* a pump. See Matsuda, col. 8, lines 33-35.

For at least the foregoing reasons, claim 1 would not have been rendered obvious over the combination of '640 and Matsuda. Moreover, there would not have been a reason to combine '640 and Matsuda, because doing so would not have obtained the features of at least claim 1. Claims 2-5 and 8-17 variously depend from claim 1 and, thus, also would not have been rendered obvious by the combination of '640 and Matsuda. Accordingly, reconsideration and withdrawal of the rejection are earnestly solicited.


**V. Conclusion**

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-5 and 8-17 are earnestly solicited.



Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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